REMARKS

Claims 15-28 are pending in this application.

REJECTIONS UNDER 35 U.S.C. § 112 (¶1)

Claims 15-17 and 20-28 stand rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which allegedly was not described in the specification. The Examiner has requested clarification as to where the support for specific limitations set forth in claims 15, 20, 21, 24, and 25 can be found. For each of the rejected claims, the allegedly unsupported claim limitation is set forth below followed by a quotation of supporting text from the specification, followed by an explanation of the meaning of the supporting specification text. The explanation is believed to be helpful because the specification was written by a person for whom English is not his native language. Thus, the specification includes somewhat non-idiomatic English with terminology that has a specific meaning in the context of the present application as would be understood by a person of ordinary skill in the art.

Claim 15

> *determining which of the plurality of images overlap or partially overlap others of the plurality of images;*
> *disregarding those images which overlap or partially overlap one or more other images; and*
> *constructing a two-dimensional image of the fingerprint surface from only non-overlapping images obtained from said generating step.*

Claim 24

> *using the ascertained speed to determine which of the plurality of images overlap or partially overlap others of the plurality of images;*
> *disregarding those images which overlap or partially overlap one or more other images; and*
> *constructing a two-dimensional image of the fingerprint surface from only non-overlapping images obtained from said generating step.*

Supporting Specification Text

> [T]he movement is measured by correlating or comparing the signals from the different sensor lines, and the time lapse or spatial shift between the measurements of corresponding structures in the surface is found. (p. 5, l. 19-23).
>
> Another method for adjusting for the movement of the finger is to maintain the sampling rate at the sensor array, while adjusting the number of measured lines used in generating the segmented image of the surface, and thus the interval of the measurements according to movement in order to obtain at least one measurement of each portion of the surface. For example, if the fingerprint is moved slowly over the sensor, while the sampling or measuring frequency is high, the redundant data may simply be neglected and the image of the fingerprint is comprised by each second or third set of data. (p. 5, l. 25-35).

Explanation of Meaning

In the context of the specification of this application, the term "movement" is synonymous with "speed." (See the accompanying Rule 132 Declaration of the inventor Jon Tschudi, ("Tschudi Decl."), ¶9). This is evident from, for example, the passage quoted at lines 19-23 of page 5. Correlating the signals (i.e., measurements, or images) generated by the different sensor lines and the time lapse or spatial shift between the lines will give the speed of movement of the finger surface across the sensor. (Tschudi Decl. ¶9).

The specification further describes a method for adjusting for the movement (i.e., speed) of the finger by maintaining the sample rate while adjusting the number of lines (i.e., images) used in generating the segmented image. Since the sample rate is maintained, thereby generating the same number of data measurement lines, or images, the only way to "adjust" the number of lines (i.e., images) used to generate the segmented image is to discard some of the lines. (Tschudi Decl. ¶10). The quoted portion of the specification further explains that the interval of measurements (i.e., the spacing between measured lines) is adjusted according to the

"movement" (i.e., speed) so that at least one measurement of each portion of the fingerprint surface is retained.[1] (Tschudi Decl. ¶10).

In the example provided in the quoted text, slow finger movement combined with a high sampling frequency (i.e., rate) will result in redundant data (i.e., overlapping images). This is because slow finger movement with a high sampling rate can result in images being generated at time intervals that are less than the time required for the finger to move the width of the sensor line. (Tschudi Decl. ¶11). The "redundant data" (i.e., overlapping images) is "neglected" (i.e., discarded) so that, in the example provided, the two-dimensional segmented image of the fingerprint is comprised by each second or third set of data (i.e., the images between each second or third image are discarded). (Tschudi Decl. ¶11).

Claims 20 & 21

> *using the ascertained speed to determine the required relative positioning of at least a portion of the plurality of images to form a two dimensional image of the fingerprint surface larger than any one of the plurality of images.*

Supporting Specification Text

> [T]he movement is measured by correlating or comparing the signals from the different sensor lines, and the time lapse or spatial shift between the measurements of corresponding structures in the surface is found. (p. 5, l. 19-23).
>
> Another method for adjusting for the movement of the finger is to maintain the sampling rate at the sensor array, while adjusting the number of measured lines used in generating the segmented image of the surface, and thus the interval of the measurements according to movement in order to obtain at least one measurement of each portion of the surface. For example, if the fingerprint is moved slowly over the sensor, while the sampling or measuring frequency is high, the redundant data may simply

[1] It is noted that only claim 24 recites using the ascertained speed to identify overlapping images; claim 5 recites identifying overlapping images, but is not limited to identifying the overlapping images using the ascertained speed.

be neglected and the image of the fingerprint is comprised by each second or third set of data. (p. 5, l. 25-35).

Explanation of Meaning

The text supporting this limitation of claims 20 and 21 is the same as the text supporting the allegedly unsupported limitations of claims 15 and 24. As explained above, this portion of the specification describes a method whereby a two-dimensional segmented image is formed using fewer than all the measured data lines in accordance with the movement (i.e., speed) of the fingerprint surface. Thus, based on the speed of movement of the fingerprint surface relative to the sensor, the relative positioning of the images of which the two-dimensional image is formed is determined.

Claim 25

means for determining which of the plurality of images overlap or partially overlap others of the plurality of images from the speed determined by said two sensing elements and to disregard those images which overlap or partially overlap one or more other images; and

means for constructing a two-dimensional image of the fingerprint surface from only non-overlapping images generated by said sensor array.

Supporting Specification Text

[T]he movement is measured by correlating or comparing the signals from the different sensor lines, and the time lapse or spatial shift between the measurements of corresponding structures in the surface is found. (p. 5, l. 19-23).

Another method for adjusting for the movement of the finger is to maintain the sampling rate at the sensor array, while adjusting the number of measured lines used in generating the segmented image of the surface, and thus the interval of the measurements according to movement in order to obtain at least one measurement of each portion of the surface. For example, if the fingerprint is moved slowly over the sensor, while the sampling or measuring frequency is high, the redundant data may simply be neglected and the image of the finger print is comprised by each second or third set of data. (p. 5, l. 25-35).

> Figure 3 shows a simplified view of the apparatus according to the invention comprising conductors from the sensors 1 to an amplifier and multiplexer 8. The signal is then digitized in an A/D-converter 9 before the digital signal is sent to a computer 10 comprising any available computer program being able to analyse the signal. (p. 5, l. 39 - p. 6, l. 4, see also Figure 3).

Explanation of Meaning

The support for the functionality recited in apparatus claim 25 is described above with respect to the allegedly unsupported limitations of claims 15 and 24.

The specification further describes, in the text quoted above and Figure 3, apparatus structure including: an amplifier and multiplexer, an A/D-converter, and a programed computer. The functionality recited in the rejected limitations of claim 25 is accomplished via software executed by the computer, thereby providing the "means for determining" and the "means for constructing." (Tschudi Decl. ¶12).

* * *

As demonstrated above, the presently pending claims are supported by the specification. Accordingly, withdrawal of the rejection of claims 15-17 and 20-28 under 35 U.S.C. §112, first paragraph, is respectfully requested.

* * *

PRIOR ART REJECTIONS

Claims 15 and 16.

Claims 15 and 16 stand rejected under 35 U.S.C. §102(e) as being anticipated by Mainguet (6,289,114). The applicant respectfully traverses the rejection.

It is noted that in assessing the patentability of the claims over the prior art, the Examiner did not consider those limitations which allegedly are not supported by the specification. As demonstrated and explained above, however, all limitations are supported by the specification, and thus, all limitations should be considered in assessing patentability.

Independent claim 15, in its entirety, is distinguishable from Mainguet '114 because Mainguet '114 does not describe, inter alia, a methodology for sensing a fingerprint which includes the steps of determining which of the plurality of images overlap or partially overlap, disregarding those images which overlap or partially overlap, and constructing a two-dimensional image of the fingerprint surface from only non-overlapping images.

The Mainguet disclosure, in fact, teaches away from the present invention. The Mainguet system and methodology specifically requires overlapping images from which a reconstituted image is created.

> There should be overlapping by at least one row between two successive images given by the sensor but, in practice, overlapping by about five to six rows appears to be necessary in order to overcome certain defects of the sensor and make the system more tolerant to losses of image quality, given that the average distance between two consecutive lines of the fingerprint is about 120 micrometers. The sensor must have a number of rows sufficient to enable the reconstitution, without excessive difficulty, of the complete image of the fingerprint.

(Col. 5, lines 33-42). Mainguet thereafter employs a complex and computationally intensive algorithm to construct a fingerprint image from the overlapping partial images. As explained in the specification and illustrated in Figs. 5-12 of Mainguet, the algorithm constructs the fingerprint image by adjusting the relative positions of adjacent, overlapping images until the fingerprint features (as reflected in the partial images) in the overlapping portions of the adjacent partial images match with specified precision. (See Col. 8, lines 31- 51; see also, Tschudi Decl. ¶13). The adjacent images must have overlapping portions, or the algorithm will not work.

The system and methodology claimed in this application, on the other hand, discards the overlapping images and constructs the fingerprint image only from non-overlapping images, so the algorithm for constructing the image is simpler and less computationally intensive than Mainguet's. (Tschudi Decl. ¶13).

Accordingly, Mainguet '114 does not anticipate independent claim 15, so the rejection of claim 15 should be withdrawn.

Dependent claim 16 is allowable as being dependent from allowable base claim 15.

Claims 18 and 19.

Claims 18 and 19 stand rejected under 35 U.S.C. §102(e) as being anticipated by Setlak (5,828,773). The applicant respectfully traverses the rejection.

Claim 18 recites a method of sensing a fingerprint comprising:

> applying a varying voltage to a finger positioned over an electrode; and
>
> measuring the capacitance or impedance between the electrode and a capacitive sensor array through a fingerprint surface positioned over the electrode and the capacitive sensor array, wherein the capacitive sensor array is separately disposed from the electrode and the capacitive sensor array is adapted to detect variations in capacitance or impedance across the array caused by structural features of a portion of the fingerprint surface positioned over the array. (emphasis added).

Setlak '773 does not disclose the recited combination of claim 18 and in particular does not disclose "applying a varying voltage to a finger" or "measuring the capacitance or impedance between the electrode and a capacitive sensor array through a fingerprint surface positioned over both the electrode and the capacitive sensor array, wherein the capacitive sensor array is separately disposed from the electrode."

Regarding the disclosure of Setlak '773, it is stated in the Office Action that "capacitance between electrode 71 and sensor array elements 78 through finger surface 79 is measured by the sensor elements." The applicant respectfully disagrees. As shown in Figure 8 in Setlak '773, the finger surface 79 is not placed over electrode 71 and sensor array 78, but is placed between array 78 and the external, grounded electrode 54. (Tschudi Decl. ¶14). The capacitance between electrode 71 and sensor 78 is constant and is independent of the finger. This capacitance is only affected by the electrode geometry and the dielectric between them. Thus, rather than measuring this capacitance, Setlak measures the changes in the field between the electrode and the sensor array depending on the presence of the finger. (Tschudi Decl. ¶15).

It is also stated in the Office Action that "Figure 6 shows sensor array 78 and electrode 71 are disposed in separate layers." This arrangement of the sensor array 78 and electrode 71 does

not, however, provide a system with a sensor array and a separately disposed electrode in which a signal passes from the electrode, through the finger, and to the sensor so that the capacitance or impedance between the electrode and the sensor array can be measured through the finger. The signal in Setlak passes directly from the electrode 71 to the sensor array 78. (Col. 6, ln. 66 - Col. 7, ln. 1; Fig. 8; See also Tschudi Decl. ¶16).

In the present invention, as recited in claim 18, a voltage (i.e., a reference potential) is applied at conductive material surrounding the sensor array (i.e., a separately disposed electrode). (See Pg. 3, ln. 35 - Pg. 4, ln. 2 and Pg. 6, lns. 14-17). The sensor array measures the signal passing from the conductive material through the finger, and this signal is indicative of the capacitance and/or the impedance through the finger. The signal to the sensor array exists only when the finger is placed over the sensor array and the electrode. (Pg. 6, lns. 35-36; See also Tschudi Decl. ¶17).

Setlak, on the other hand, does not apply a varying voltage to the finger. In Setlak, the excitation signal is constantly applied to the sensor. (Tschudi Decl. ¶18). "The excitation drive signal . . . is coherently delivered across all of the array." (Col. 6, lns. 40-42). This can also be appreciated from Figure 9 of Setlak, which shows that the excitation signal is applied to the capacitive element 83 (which is defined between the excitation electrode 71 and the sensing electrode 78 (see Col. 7, lns. 3-5)), and the signal output is constantly measured through amplifier 73. (Tschudi Decl. ¶18). The measured signal varies when variable capacitor 85 (which is defined between the finger 79 and the ground (see Col. 7, lns. 5-7)) is placed on the sensor, and the amount of variation depends on whether the particular sensor is near a ridge or valley of the fingerprint surface. (see Col. 7, lns. 7-9). Thus, the fingerprint characteristics are derived from the amount of signal variation that occurs when a fingerprint is placed on the sensor.

The claimed system and method, on the other hand, derives the fingerprint characteristics from the absolute strength of a signal (as opposed to the relative variation) that exists only when the finger is placed on both the exciting electrode and the sensor array. (Tschudi Decl. ¶¶17, 20-21). As compared to Setlak's sensor, the sensor of the present invention is much more sensitive

to actual fingerprint characteristics while being less sensitive to environmental variations. (Tschudi Decl. ¶20-21).

The differences between the present invention and the sensor of Setlak can be effectively illustrated by a simple example. The Setlak sensor is analogous to a circuit that powers a light bulb. The light bulb is constantly illuminated, but if one were to place his finger on the circuit, the intensity of the light bulb would change. It is the change in intensity the Setlak measures to derive the fingerprint characteristics. (Tschudi Decl. ¶22). The present invention is analogous to a light bulb circuit that is open until one completes the circuit with his finger to cause the bulb to illuminate. The sensor of the present invention derives the fingerprint characteristics from the intensity of the bulb, not the change in intensity. (Tschudi Decl. ¶22).

Accordingly, claim 18, and claim 19 depending therefrom, are not anticipated by the teachings of Setlak '773, so the rejections of claims 18 and 19 should be withdrawn.

Claim 17

Claim 17 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Mainguet '114 in view of Dowdy (3,622,989).

It is noted that in assessing the patentability of claim 17 with respect to the prior art, the Examiner did not consider those features which were allegedly not supported by the specification. As demonstrated and explained above, however, all limitations are supported by the specification, and thus, all limitations should be considered in assessing patentability.

Claim 17 depends from independent claim 15, and is believed to be allowable as there is no teaching in Dowdy '989 to overcome the deficiencies of Mainguet '114 with respect to independent claim 15. That is, Dowdy '989 does not disclose a methodology whereby overlapping partial images are identified and discarded and the fingerprint image is constructed from only non-overlapping images.

Moreover, Dowdy '989 describes a system for identifying a fingerprint of a stationary finger placed on the sensor. (See Col. 1, lns. 46-51). The signals generated by the sensor of Dowdy '989 would have been incompatible with the algorithm of Mainguet '114, and thus there would have been no motivation to have incorporated the teachings of Dowdy '989 into the device

and methodology of Mainguet '114. "When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references." In re Rouffet, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998); see also MPEP § 2143.01. Absent some motivation to combine the references in the manner suggested, the proposed combination is an impermissible hindsight reconstruction of the applicant's invention. See Rouffet, 27 USPQ2d at 1457-1458.

Accordingly the subject matter of claim 17 is not obvious from Mainguet '114 and Dowdy '989, so the rejection of claim 17 should be withdrawn.

Claims 20 and 24

Claims 20 and 24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Setlak '773 in view of Mainguet '114 and Upton (5,864,296). The applicant respectfully traverses the rejections.

It is noted that in assessing the patentability of claims 20 and 24, the Examiner did not consider those limitations which were allegedly not supported by the specification. As demonstrated and explained above, however, all limitations are supported by the specification, and thus, all limitations should be considered in assessing patentability.

Claim 20 recites the steps of ascertaining the speed of movement of the fingerprint by sensing structural features of the fingerprint surface moved over two sensing elements spaced apart by a predetermined distance and determining the speed from the predetermined distance and a time lapse between passage of identical structural features, and using the ascertained speed to determine the required relative positioning of at least a portion of the plurality of images to form a two-dimensional image of the fingerprint surface. The subject matter of claim 20 is not rendered obvious from the teachings of Setlak, Mainguet, and Upton.

Claim 20 depends from claim 18 and is therefor believed to be allowable as depending from an allowable claim. In addition, claim 20 is believed to be allowable for the following reasons.

Mainguet describes a low cost sensor comprising only one row of sensitive elements and explains that in order to obtain an undistorted reconstitution of the complete image of the

fingerprint, it would be necessary to have precise knowledge of the speed of relative shift of the finger with respect to the sensor. (Column 4, lines 62 - column 5, line 3). Mainguet does not, however, explain how one can use knowledge of the speed of the finger relative to the sensor to obtain an undistorted reconstitution of the complete image and does not suggest that the speed of the finger can be determined by the sensor. Moreover, the only manner described for knowing the speed of the finger relative to the sensor is by moving the sensing elements at a known speed relative to a stationary finger using a servo-controlled motor. (Column 5, lines 3-7). There is no suggestion, however, that the servo-controlled motor is controlled by the output of the sensors, so there is no evaluation of the speed of the finger by the sensors. In the preferred embodiment described in Mainguet '114, in which the sensor comprises several rows of sensitive elements, knowledge of the speed of the finger movement relative to the sensor is not required. Adjacent images are put together by adjusting their relative positions until the fingerprint features found in the overlapping areas match. (Col. 8, lns. 31-51; see also Tschudi Decl. ¶13).

Upton '296 describes that the rows of sensing elements are spaced at a predetermined distance which allows a "fingerprint velocity function" to be measured. (Column 4, lines 15-17). Upton does not explain what a "fingerprint velocity function" is or how it is measured. Thus, Upton does not enable the "ascertaining" step of claim 20.

In addition, Upton does not describe that the "velocity function" can be used to determine the relative positions of partial images. Upton describes that the velocity is measured to optimize the sample frequency to provide a fingerprint detection and verification method that is independent of fingertip velocity. (Column 8, lines 15-39).

Accordingly, the combined disclosures of Mainguet and Upton do not describe a process whereby the speed of movement of the fingerprint is ascertained by sensing structural features of the fingerprint surface moved over two sensing elements spaced apart by a predetermined distance and determining the speed from the predetermined distance and a time lapse between passage of identical structural features of the fingerprint surface from one of the two sensing elements to the other and using the ascertained speed to determine the required relative positioning of at least a portion of the plurality of images to form a two-dimensional image of the fingerprint surface.

Accordingly, claim 20 is not obvious from Mainguet '114, Upton '296, and Setlak '773, and withdrawal of the rejection of claim 20 is respectfully requested.

Claim 24 recites applying a varying voltage to a finger positioned over an electrode and measuring the capacitance or impedance between the electrode and a separately disposed sensor array through the finger, ascertaining the speed of movement of the fingerprint surface relative to the sensor array by sensing structural features of the fingerprint surface moved over two sensing elements spaced by a predetermined distance and determining the speed from the predetermined distance and a time lapse between passage of identical structural features of the fingerprint, using the ascertained speed to determine which of the plurality of images overlap or partially overlap others of the plurality of images, disregarding those images which overlap or partially overlap, and constructing a two-dimensional image of the fingerprint surface from only non-overlapping images. The cited references do not disclose all of these process steps.

As explained above with respect to claim 18, Setlak does not describe a system or methodology for applying a varying voltage to the finger and measuring the capacitance or impedance through a finger placed over the electrode and a separately disposed sensor array. And, as explained above with respect to claim 20, Upton and Mainguet do not, either individually or in combination, teach or suggest the steps of ascertaining the speed by measuring the time lapse between passage of identical structural features. Finally, as explained above with respect to claim 15, Mainguet does not teach or suggest the steps of determining overlapping images, disregarding overlapping images, or constructing a two-dimensional image from only non-overlapping images.

Therefore, claim 24 is not obvious from Mainguet '114, Upton '296, and Setlak '773 and withdrawal of the rejection is requested.

Claims 21-23 and 25

Claims 21-23 and 25 stand rejected under 35 U.S.C. §103 as being unpatentable over Mainguet '114 and Upton '296. The rejection is respectfully traversed.

It is noted that in assessing the patentability of claims 21-23 and 25, the Examiner did not consider those features allegedly not supported by the specification. As demonstrated and

explained above, however, all limitations are supported by the specification, and thus, all limitations should be considered in assessing patentability.

Claim 21 recites ascertaining the speed of movement of the fingerprint surface relative to the sensor array by sensing structural features of the fingerprint surface moved over two sensing elements spaced apart by a predetermined distance and determining the speed from the predetermined distance and a time lapse between passage of identical structural features, and using the ascertained speed to determine the required relative positioning of at least a portion of the plurality of images to form a two-dimensional image of the fingerprint surface.

As explained above, while Mainguet mentions that knowledge of the speed of the finger relative to the sensor is necessary to obtain an undistorted reconstituted image, it does not explain how the undistorted image is obtained (once the speed is known) or how the speed is measured.

Upton '296 describes a methodology and apparatus whereby a sample trajectory signal is normalized by correcting the sampling rate in direct proportion to the sample trajectory signal frequency. Thus, an increase in fingertip velocity across the sensing array will cause a proportional increase in the sampling rate, and a decrease in fingertip velocity will cause a proportional decrease in the sampling rate. (Upton, column 8, lines 15-39). There is no disclosure in Upton '296 of using the ascertained speed to determine the required relative positioning of at least a portion of the plurality of images. Moreover, while Upton mentions measuring a fingerprint velocity function, it does not explain what such a function is or how it is measured.

Accordingly, the subject matter of claim 21 is not obvious from the teachings of Mainguet '114 and Upton '296, so the rejection of claim 21 should be withdrawn.

Claims 22-23 depend from claim 21 and are allowable as depending from an allowable base claim.

Claim 25 is an apparatus claim which recites (a) sensing elements constructed and arranged to measure structural features passing over the elements, to determine a time lapse between passage of identical structural features, and to determine the speed of movement of the fingerprint from the time lapse and the distance between the sensing elements, (b) means for

determining which of the plurality of images overlap and to disregard those images which overlap, and (c) means for constructing a two-dimensional image of the fingerprint from only non-overlapping images. Neither of the cited references, Mainguet '114 or Upton '296, discloses structure providing the claimed functionality. Mainguet does not describe an apparatus that constructs a fingerprint image only from non-overlapping images, and, in fact, describes an apparatus that requires overlapping images for constructing the fingerprint image. Upton does not describe an apparatus for determining the speed of finger movement based on the distance between spaced-apart sensors and the time lapse between passage of identical features over the sensors.

Accordingly, the subject matter of claim 25 is not obvious from the teachings of Mainguet '114 and Upton '296, so the rejection of claim 25 should be withdrawn.

Claims 26-28.

Claims 26-28, depending from claim 25, are rejected under 35 U.S.C. §103(a) as being unpatentable over Mainguet '114, Upton '296 and Setlak '773. The rejection is respectfully traversed.

It is noted that in assessing the patentability of claims 26-28, the Examiner did not consider those features allegedly not supported by the specification. As demonstrated and explained above, however, all limitations are supported by the specification, and thus, all limitations should be considered in assessing patentability.

Claims 26-28 are believed to be allowable as being dependent from allowable base claim 25, there being nothing in the teachings of Setlak to overcome the deficiencies of Mainguet and Upton with respect to the subject matter of independent claim 25. Accordingly, withdrawal of the rejections of claims 26-28 is respectfully requested.

All rejections and objections having been addressed, it is respectfully submitted that the present application is now in condition for allowance and a notice to that effect is earnestly requested.

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ATTACHMENT: Declaration Under 37 CFR §1.132
of Jon Tschudi
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